

IN THE CLAIMS:

Please amend claims 1-3, 8, 11, 12, 8, 16, 18-20 as shown below, in which changes are indicated by strikethrough and/or underscoring. Please cancel claims 21-22 without prejudice and without dedication or abandonment of the subject matter thereof. Also, please add new claims 25-26 as shown below.

1. (Currently amended) A stator winding for use in a rotating electric machine having a slotless stator, said stator winding being a hollow cylindrical body formed by:

forming turns by winding a wire sheaf of a plurality of fine wires composed of conductors bundled together, through one turn in an approximately rhombic shape;

forming approximately rhombic shaped coil segments comprising a continuous length of said wire sheaf by winding and arranging a plurality of said turns so as to be sequentially shifted continuously in a direction of one diagonal of said rhombic shape;

forming a band shaped body using a plurality of said coil segments with these coil segments sequentially shifted in the direction of said one diagonal and so as to be adjacent to each other; and

rolling said band shaped body into a hollow cylindrical shape;

wherein with each of said respective turns, opposite end portions which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal, have bent back portions which are disposed outside of said rhombic shape.

2. (Currently amended) A stator winding according to claim 1, wherein with said wire sheaf, one end portion of said opposite end portions of said respective turns which are located in a said direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal is wound from an inner peripheral side of said hollow cylindrical body to an outer peripheral side thereof, and another end portion of said opposite end portions of said respective turns, is wound from

the outer peripheral side of said hollow cylindrical body to the inner peripheral side thereof.

3. (Currently amended) A stator winding according to claim 1, wherein ~~with said respective turns, opposite end portions which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal, have~~ said bent back portions which proceed so as to project ~~towards an~~ outside of said turn, ~~and~~ then return back in an approximately U-shape and proceed so as to return ~~towards an~~ inside of said turn.

4. (Previously amended) A stator winding according to claim 1, wherein said respective turns are arranged touching adjacent ones of said turns.

5. (Previously amended) A stator winding according to claim 2, wherein of the four sides of said approximately rhombic shaped coil segments, two said sides located on one side of said other diagonal of said rhombic shape are arranged on an inner peripheral side of said hollow cylindrical body, and the other two said sides opposite to the two said sides located on said one side are arranged on an outer peripheral side of said hollow cylindrical body.

6. (Previously amended) A stator winding according to claim 5, wherein the two sides of the coil segment which are arranged on the inner peripheral side of said hollow cylindrical body are abutted in the circumferential direction against said two sides which are arranged on the inner peripheral side of the coil segment adjacent thereto.

7. (Previously amended) A stator winding according to claim 3, wherein said bent back portions are bent from the inner peripheral side of said hollow cylindrical body towards the outer peripheral side thereof, or from the outer peripheral side of said hollow cylindrical body towards the inner peripheral side thereof.

8. (Currently amended) A stator winding ~~according to claim 1,~~ for use in a rotating electric machine having a slotless stator, said stator winding being a hollow cylindrical body formed by:

forming turns by winding a wire sheaf of a plurality of fine wires composed of conductors bundled together, through one turn in an approximately rhombic shape;

forming approximately rhombic shaped coil segments comprising a continuous length of said wire sheaf by winding and arranging a plurality of said turns so as to be sequentially shifted continuously in a direction of one diagonal of said rhombic shape;

forming a band shaped body using a plurality of said coil segments with these coil segments sequentially shifted in the direction of said one diagonal and so as to be adjacent to each other; and

rolling said band shaped body into a hollow cylindrical shape;

wherein said wire sheaf is twisted at least one turn in a helical form within a range of one side of the respective approximate rhombic shaped turns.

9. (Previously amended) A stator winding according to claim 1, wherein said wire sheaf has an approximately rectangular shaped cross-section

10. (Previously amended) A stator winding according to claim 1, wherein said fine wires have a distorted circular cross-section with linear portions, and adjacent fine wires are contacted together at said linear portions.

11. (Currently amended) A method of manufacturing a stator winding for use in a rotating electric machine having a slotless stator, said method comprising:

a turn forming step for forming turns by winding a wire sheaf of a plurality of fine wires composed of conductors bundled together, through one turn in an approximately rhombic shape;

a coil segment forming step for forming approximately rhombic shaped coil segments comprising a continuous length of said wire sheaf by winding and arranging a plurality of said turns so as to be sequentially shifted continuously in a direction of one diagonal of said rhombic shape; and

a hollow cylindrical body forming step for forming a band shaped body using a plurality of said

coil segments by overlapping these coil segments so as to be sequentially shifted in the direction of said one diagonal and adjacent to each other, and rolling said band shaped body into a hollow cylindrical shape,

said turn forming step includes a step where, with said wire sheaf, one end portion of opposite end portions of said respective turns which are located in a direction of another diagonal orthogonal to the direction of said one diagonal is wound from an inner peripheral side of said hollow cylindrical body to an outer peripheral side thereof, and another end portion of said opposite end portions of said respective turns, is wound from the outer peripheral side of said hollow cylindrical body to the inner peripheral side thereof, and also includes a bent back portion forming step for forming bent back portions wherein said opposite end portions of said respective turns are formed with bent back portions disposed outside of said rhombic shape.

12. (Currently amended) A method of manufacturing a stator winding according to claim 11, wherein ~~said turn forming step further includes a bent back portion forming step for forming bent back portions at said opposite end portions of said respective turns which are located in the direction of the other diagonal orthogonal to the direction of said one diagonal, such that each said bent back portion proceeds so as to project towards an outside of said turn, and then returns back in an approximately U-shape and proceeds so as to return towards an inside of said turn.~~

13. (Previously amended) A method of manufacturing a stator winding according to claim 11, wherein said turn forming step incorporates a press step for pressing said wire sheaf so that adjacent fine wires are closely contacted together.

14. (Previously amended) A method of manufacturing a stator winding according to claim 13, further including, prior to said press step, a step of twisting said wire sheaf at least one turn in a helical form within a range of one side of said approximately rhombic shaped turn.

15. (Previously amended) A method of manufacturing a stator winding according to claim 13, wherein said press step incorporates a step for forming said wire sheaf so that said wire sheaf has an approximately rectangular cross-section.

16. (Currently added) A stator winding according to claim 2, wherein ~~with said respective turns, opposite end portions which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal, have~~ said bent back portions which proceed so as to project ~~towards an~~ outside of said turn, and then return back in an approximately U-shape and proceed so as to return ~~towards an~~ inside of said turn.

17. (Previously added) A stator winding according to claim 3, wherein of the four sides of said approximately rhombic shaped coil segments, two said sides located on one side of said other diagonal of said rhombic shape are arranged on an inner peripheral side of said hollow cylindrical body, and the other two said sides opposite to the two said sides located on said one side are arranged on an outer peripheral side of said hollow cylindrical body.

18. (Currently amended) A stator winding for use in a rotating electric machine having a slotless stator, comprising a band shaped body of a plurality of coil segments rolled into a hollow cylindrical shape, wherein:

each of said coil segments is approximately rhombic shaped and includes a continuous length of a wire sheaf wound and arranged into a plurality of turns which are sequentially shifted continuously in a direction of one diagonal of said rhombic shape;

each of said turns is also approximately rhombic shaped;

said wire sheaf includes a plurality of fine wires composed of conductors bundled together; ~~and~~

said plurality of said coil segments of said band shaped body are sequentially shifted in the direction of said one diagonal and so as to be adjacent to each other; and

with each of said respective turns, opposite end portions which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal, have bent back portions which are disposed outside of said rhombic shape.

19. (Currently amended) A stator winding according to claim 18, wherein with said wire sheaf, one end portion of said opposite end portions of respective ones of said turns which are located in a said direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal is wound from an inner peripheral side of said hollow cylindrical body to an outer peripheral side thereof, and another end portion of said opposite end portions of said respective turns, is wound from the outer peripheral side of said hollow cylindrical body to the inner peripheral side thereof.

20. (Currently amended) A stator winding according to claim 18, wherein ~~with respective ones of said turns, opposite end portions thereof which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal,~~ have said bent back portions which proceed so as to project ~~towards an~~ outside of said turn, and then return back in an approximately U-shape and proceed so as to return ~~towards an~~ inside of said turn.

21. and 22. Cancelled

23. (Previously added) A stator winding according to claim 1, wherein outer peripheral sides of the sequentially adjacent coil segments radially overlap inner peripheral sides of the adjacent coil segments in the hollow cylindrical shape .

24. (Previously added) A stator winding according to claim 18, wherein outer peripheral sides of the sequentially adjacent coil segments radially overlap inner peripheral sides of the adjacent coil segments in the hollow cylindrical shape .

25. (New) A stator winding according to claim 1, wherein each said coil segment is sequentially shifted such that portions of multiple turns of said coil overlap with portions of multiple turns an adjacent one of said coil segments.

26. (New) A stator winding according to claim 1, wherein each said turn is wound in the same manner.

REMARKS

Initially, applicant would like to thank the Examiner and his primary/supervisor for the helpful and courteous telephonic interview they conducted with applicant's undersigned representative on July 15, 2003. No specific agreement was reached, but it was generally acknowledged that the bent back portions of each turn according to applicant's disclosed stator winding are not disclosed by the references of record, and that the current Office Action may have made prematurely final.

Upon entry of the present amendment, the claims in the application the claims in the application are claims 1-20 and 23-26, of which claims 1, 8, 11 and 18 are independent, and of which claims 11-15 have been withdrawn from consideration by the Examiner as being directed to a non-elected invention. Enclosed herewith is a check for \$84.00 in payment of the fee for presentation of a fourth independent claim.

Independent claims 1, 11 and 18 have been amended to define the bent back portions of each turn of the winding (previously defined in dependent claims 3, 12 and 16), and to further define that the bent back portions are disposed outside of said rhombic shape. Claim 8 is rewritten in independent form, including the limitations of claim 1 from which it formerly depended. Claims 21-22 are cancelled and new claims 25-25 are added which further define aspects of the winding turns and segments of claim 1. The new claims 25-26 are encompassed by the invention I previously elected by applicant.

Applicant respectfully submits that the above amendments are fully supported throughout the original disclosure, including drawing Figs. 3-5, 8 and 12. Applicant further respectfully submits that no new matter is introduced by the above amendments. Also, while the above amendments present new issue(s) for consideration by the Examiner, it is respectfully submitted that the Office Action was made prematurely final, as further discussed in the Request For Withdrawal of Finality of Office Action filed concurrently herewith.

Still further, applicant respectfully submits that in view of the above amendment to claim 8, such claim is now believed to be allowable in light of the Examiner's indication at the last paragraph on page 4 of the Office Action.

Rejection Under 35 USC §103(a)

The Examiner has rejected claims 1-7, 9, 10, and 16-24 under 35 USC §103(a), as being unpatentable over the conventional winding of Figs. 15-16 and the windings shown on page 47 of the textbook by Kenjo, each in view of Marchegiani (WO 90/10336), presented at pages 3-4 of the Office Action. Further, the Examiner presents a "Response to Amendment" on pages 2-3 of the Office Action, in which the Examiner further explains

his rejection, taking issue with the argument presented in Amendment-B that the stator winding of Figs. 15-16 is not “multilayer” based on the teachings of Kenjo, as well as on the disclosure of US Patent 3,995,364 (Kristiansen) which discloses a winding such as that shown in Figs. 15-16 and a method of manufacturing same, and specifically indicates that the winding is “multilayer”. Still further, in the “Response to Amendment” the Examiner presents an inquiry regarding the approximately U-shape bent back portions as defined in claims 3, 12 and 16.

It is the Examiner’s position that the conventional winding of Figs. 15-16 and Kenjo include all of the features of the rejected claims, except for the features involving use of a sheaf of fine wires bundled together, etc, and that it would have been obvious to a person skilled in the art at the time of the present invention to have modified the conventional winding to be formed from a sheaf of fine wires having the claimed characteristics based on the teachings of Marchegiani.

Applicant’s Response

Upon careful consideration and in light of the above amendments, applicant respectfully submits that the rejection is overcome and that each of present claims 1-7, 9, 10, and 16-20, 23 and 24 is clearly patentably distinct over the applied because the conventional windings of Figs. 15-16, Kenjo, Marchegiani (and Kristiansen) do not include or suggest many features of the claimed stator winding, nor do the conventional windings achieve the significant advantages that are achieved by the claimed invention, as discussed in the application and prior Amendment-B.

Initially, applicant respectfully submits that the applied art does not teach or suggest winding turns having bent back portions as now defined in claims 1 and 18, i.e., wherein opposite end portions which are located in a direction of another diagonal of said rhombic shape orthogonal to the direction of said one diagonal, have bent back portions which are disposed outside of said rhombic shape. Rather, in each of the applied art windings, the winding turns are rectangularly shaped, with no bent back portions disposed outside of the rectangular (rhombic) shape.

Further, applicant respectfully submits that the applied art does not teach or suggest the claimed winding which is formed as a hollow cylindrical body formed by multiple steps as defined in claims 1 and 18, i.e., forming rhombic shaped turns of the wire sheaf, forming approximately rhombic shaped coil segments of a continuous length of the wire sheaf by arranging a plurality of the turns so as to be sequentially shifted *in the direction* (singular) of one diagonal of the rhombic shape, forming a band shaped body with a plurality of the coil segments sequentially shifted in the direction of *the one diagonal* and rolling the band into a hollow shaped body. As discussed throughout the present application, use of the intermediate steps/features of forming the coil segments from a plurality of continuous turns, and then forming the band shaped body from a plurality of the coil segments sequentially shifted in the direction of

the one diagonal results in a multi-layered construction for higher output and miniaturization of the stator.

Conversely, while the conventional winding of the applied art may include a multi-layered hollow cylindrical body, as understood from the disclosures of Kenjo and Kristiansen, the conventional method steps used in forming such body are clearly quite different than those defined in the present claims, as best understood from the full disclosure of Kristiansen. Particularly, as understood from Kristiansen's Figs. 2-3 and the discussion of same, there are *no distinct segments* formed by arranging a plurality of rhombic shaped turns arranged so as to be sequentially shifted *continuously in a direction of one diagonal* of the rhombic shape, nor is there a band shaped body formed using a plurality of the coil segments *sequentially shifted in the direction of the one diagonal* so as to be adjacent to each other. Rather, in the conventional windings, the band shaped body is formed as *one continuous segment* including multiple layers of rhombic shaped turns of wire, wherein the turns in each layer are shifted (theoretically by one half the diameter of the wire) from the turns in adjacent layers by *reversing the direction of axial advancement of the turns after every few turns are wound*. There is no winding of turns so as to be *sequentially shifted in a (one) direction* to form segments, and there is no sequential shifting of segments to form a band shaped body.

Thus, even if the single wire of the conventional winding is replaced with a stranded conductor sheaf, such as disclosed by Marchegiani, any resulting winding would still not achieve the invention of claims 1 and 18 involving plural shifted segments.

Further, applicant respectfully submits that the additional, related features of the dependent claims pertaining to the multi-layer structure of the claimed winding and just how it is achieved according to the invention, are also not achieved or suggested by the applied art. For example, claims 2 and 19 define the specific manner in which opposite end portions of respective turns (each turn) located in a direction of a diagonal orthogonal to the direction of axial advancement/shifting of the turns are wound opposite to each other relative to outer and inner peripheral sides of the hollow cylindrical body, while claims 3 and 20 define that the approximately U-shape of the bent back portions. As explained throughout the application, particularly in relation to Figs. 3-5 and 8, such claimed features result in the slotless stator which realizes high output and miniaturization in comparison to the conventional stator windings such as shown in Figs. 15-16, which are not wound in the defined manner, and do not include the discussed bent back portions.

In this regard, applicant believes that the Examiner's comment/inquiry at the paragraph bridging pages 2-3 of the Office Action is answered by the above amendments to claims 1 and 18.

Based on the foregoing, applicant respectfully submits that the Examiner's rejection under 35 USC §103(a) is overcome in relation to present claims 1-7, 9, 10, 16-20, 23 and 24.

Accordingly, it is respectfully requested that such rejection be reconsidered and withdrawn.

Other References Cited in the Office Action

The additional reference cited and discussed by the Examiner at bottom of page 5 of the Office Action (Keim) has been considered by applicant, but it is respectfully submitted that this additional reference fails to overcome the deficiencies of the applied art as discussed above relative to the claimed invention.

New Claims

New claim 25-26 are believed to be allowable over the references of record based on the foregoing arguments regarding the merits of claim 1, as well as on the merits of the additional features recited therein.

Conclusion

In conclusion, applicant has overcome the Examiner's rejection of claims as presented in the Office Action; and moreover, applicant has considered all of the references of record, and it is respectfully submitted that the invention as defined by each of the present claims is clearly patentably distinct thereover.

The application is now believed to be in condition for allowance, and a notice to this effect is earnestly solicited.

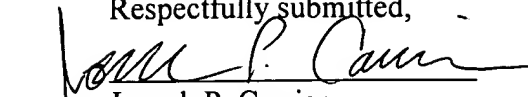
Again, entry of the present amendment is respectfully requested under 37 CFR 1.116 on the ground that the Office Action has been made prematurely final as further discussed in the Request For Withdrawal of Finality of Office Action filed concurrently herewith.

If the Examiner is not fully convinced of all of the claims now in the application, applicant respectfully requests that the Examiner telephonically contact applicant's undersigned representative to expeditiously resolve prosecution of the application.

Favorable reconsideration is respectfully requested.

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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited as First Class Mail with the US Postal Service in an envelope addressed to Mail Stop After Final, Commissioner for Patents, PO Box 1450, Alexandria, VA 22313-1450, on August 21, 2003.

Dated: August 21, 2003

JPC/ms

